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A Fish Habitat Survey Of The Jacquet River Watershed, Restigouche County, N.B. Volume 4: Species Composition and Relative Abundance Of Benthic Macro-invertebrates

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Fisheries and Aquatic Sciences No.724 (Vol. 4)

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by

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ABSTRACT

Ritchie, W.B., 1989. A Fish Habitat Survey of the Jacquet River Watershed, Restigouche County, N.B. Volume 4 - Species Composition and Relative Abundance of Benthic Macro-invertebrates. Can. Data Rep. Fish. Aquat. Sci. 724 (Vol. 4), 45p.

This report, Volume 4 of a four volume series, is a compilation of benthological data collected on the Jacquet River System in August, 1984. Species composition and relative abundance of benthic macro-invertebrates are presented. Other topics are :

Volume 1 - Hydraulic and Physiographic Data
Volume 2 - Water and Sediment Chemistry Data
Volume 3 - Estimated Fish Densities and Biological Data for Salmonid Specimens

Key words: benthic macro-invertebrate, Surber sampler, Ekman dredge, relative abundance, species composition.

RESUMÉ

Ritchie, W.B., 1989. A Fish Habitat Survey of the Jacquet River Watershed, Restigouche County, N.B. Volume 4 - Species Composition and Relative Abundance of Benthic Macro-invertebrates. Can. Data Rep. Fish. Aquat. Sci. 724 (Vol. 4), 45p.

Ce rapport, le quatrième d'une série de quatre volumes, consiste d'une compilation de données benthologiques recueillies sur le réseau hydrographique Jacquet en août 1984. La composition d'espèces et l'abondance relative des macro-invertébrés benthiques sont présentées. D'autres sujets sont:

Volume 1 - Hydraulic and Physiographic Data
Volume 2 - Water and Sediment Chemistry Data
Volume 3 - Estimated Fish Densities and Biological Data for Salmonid Specimens

Mots clés: macro-invertébrés benthiques, échantillonneur Surber, drague Ekman, abondance relative, composition d'espèces

TABLE OF CONTENTS

VOLUME 4

PAGE

Abstract/Resume iii
Introduction 1
Materials and Methods 1
Acknowledgements 2
References 2

LIST OF FIGURES

PAGE

Figure 4.1 Location of sampling sites, Jacquet River watershed 3

SITE 1, JACQUET RIVER
Figure 4.2 Location of benthos sampling stations 4

SITE 2, LOWER MCNAIR BROOK
Figure 4.3 Location of benthos sampling stations 6

SITE 3, BIG HOLE BROOK
Figure 4.4 Location of benthos sampling stations 9

SITE 5, ANTINOURI LAKE
Figure 4.5 Location of benthos sampling stations 12

SITE 6, ROCKY BROOK
Figure 4.6 Location of benthos sampling stations 14

SITE 8, LOWER SOUTH BRANCH JACQUET RIVER
Figure 4.7 Location of benthos sampling stations 17

SITE 9, BIG HOLE BROOK
Figure 4.8 Location of benthos sampling stations 19

SITE 10, TONGUE LAKE BROOK
Figure 4.9 Location of benthos sampling stations 22

SITE 11, HEAD LAKE
Figure 4.10 Location of benthos sampling stations 25

SITE 12, LOWER SOUTH BRANCH JACQUET RIVER
Figure 4.11 Location of benthos sampling stations 27

SITE 13, UPPER MCNAIR BROOK
Figure 4.12 Location of benthos sampling stations 29

SITE 14, JACQUET RIVER
Figure 4.13 Location of benthos sampling stations 31

SITE 15, JACQUET RIVER
Figure 4.14 Location of benthos sampling stations 33

SITE 16, JACQUET RIVER
Figure 4.15 Location of benthos sampling stations 36

SITE 17, JACQUET RIVER
Figure 4.16 Location of benthos sampling stations 39

SITE 18, UPPER SOUTH BRANCH JACQUET RIVER
Figure 4.17 Location of benthos sampling stations 41

SITE 19, LOWER MCNAIR BROOK
Figure 4.18 Location of benthos sampling stations 43

LIST OF TABLES

PAGE

SITE 1, JACQUET RIVER
Table 4.1 Species composition and relative abundance of benthic macro-invertebrates..... 5

SITE 2, LOWER MCNAIR BROOK
Table 4.2 Species composition and relative abundance of benthic macro-invertebrates 7

SITE 3, BIG HOLE BROOK
Table 4.3 Species composition and relative abundance of benthic macro-invertebrates..... 10

SITE 5, ANTINOURI LAKE
Table 4.4 Species composition and relative abundance of benthic macro-invertebrates..... 13

SITE 6, ROCKY BROOK
Table 4.5 Species composition and relative abundance of benthic macro-invertebrates..... 15

SITE 8, LOWER SOUTH BRANCH JACQUET RIVER
Table 4.6 Species composition and relative abundance of benthic macro-invertebrates..... 18

SITE 9, BIG HOLE BROOK
Table 4.7 Species composition and relative abundance of benthic macro-invertebrates..... 20

SITE 10, TONGUE LAKE BROOK
Table 4.8 Species composition and relative abundance of benthic macro-invertebrates..... 23

SITE 11, HEAD LAKE
Table 4.9 Species composition and relative abundance of benthic macro-invertebrates..... 26

SITE 12, LOWER SOUTH BRANCH JACQUET RIVER
Table 4.10 Species composition and relative abundance of benthic macro-invertebrates..... 28

SITE 13, UPPER MCNAIR BROOK
Table 4.11 Species composition and relative abundance of benthic macro-invertebrates..... 30

SITE 14, JACQUET RIVER
Table 4.12 Species composition and relative abundance of benthic macro-invertebrates 32

SITE 15, JACQUET RIVER
Table 4.13 Species composition and relative abundance of benthic macro-invertebrates..... 34

SITE 16, JACQUET RIVER
Table 4.14 Species composition and relative abundance of benthic macro-invertebrates..... 37

SITE 17, JACQUET RIVER
Table 4.15 Species composition and relative abundance of benthic macro-invertebrates..... 40

SITE 18, UPPER SOUTH BRANCH JACQUET RIVER
Table 4.16 Species composition and relative abundance of benthic macro-invertebrates..... 42

SITE 19, LOWER MCNAIR BROOK
Table 4.17 Species composition and relative abundance of benthic macro-invertebrates..... 44

INTRODUCTION

The Jacquet River, a medium sized salmon stream approximately 50 km in linear length in Restigouche Co., New Brunswick contains ideal spawning and rearing habitat for Atlantic salmon *(salmo salar)*. With the exception of logging activity, the watershed is largely undeveloped. In 1965, Brunswick Mining and Smelting, Ltd. installed a water intake structure approximately 2 km from the mouth of the Jacquet River. They are presently operating on a water license from the New Brunswick Department of Fisheries and Environment (now the N.B. Dept. of Municipal Affairs and Environment). This license, renewed in 1974, expiring in 1979 and not since renewed, entitles them to withdraw 39312 cu. meters/day for their consumption in the lead smelter and the fertilizer plant as well as for domestic use in two adjacent town sites in Belledune.

Five previous studies of the river have been undertaken within the last twenty years. Three were qualitative in scope offering visual descriptions of available habitat and fish present (Smith 1956, N.B.D.N.R. (unpublished 1969 report), and IEC Beak 1984). Two studied the micro-habitat requirements of salmon in the area downstream from the water intake station (Morantz 1983, IEC Beak 1982). None of these studies presented quantitative data for water or sediment quality or hydrology.

In August, 1984, the Gulf Region's Fish Habitat Division conducted a survey on the Jacquet River to determine site-specific baseline conditions for hydrology, water chemistry, sediment chemistry, fish and macro-invertebrate populations, and habitat quality. The area of study consisted of 24 sites along the main stem of the river and seven of its major tributaries: Big Hole Brook, Antinouri Lake Brook, Lower South Branch, Lower McNair Brook, Upper South Branch, Upper McNair Brook and Rocky Brook. This report, the fourth in a series of four data reports, presents the benthological data collected on the survey.

MATERIALS AND METHODS

Benthic macro-invertebrate sampling within the Jacquet River Watershed was conducted at study site locations selected according to criteria described in Volume 1 of this series.

A Surber sampler was used for benthic macro-invertebrate sampling in streams and an Ekman dredge was used at one lake site.

The Surber sampler supplied by Wildco (Saginaw Mi., U.S.A.) consists of hinged brass frames attached to a nylon net with mesh openings of 1024 microns. The brass frame confines an actual sampling area of .09 m^2.

Three Surber samples were collected from each of 16 stream study sites. Each sampling station was considered to be typical of benthic invertebrate habitat and had adequate stream flow to permit effective operation of the sampler. The sampler was placed on the stream substrate and firmly held in position while substrate within the brass frame was cleaned for a period of 60 seconds, allowing benthic invertebrates and organic material to detach from the substrate and drift into the net. Contents of the net were then washed into a pail having a screened bottom, transferred to 500 ml polyethelene bottles and preserved in a 10% formaldehyde solution.

Three Ekman dredge samples were collected at selected sampling stations at one lake. The Ekman dredge, supplied by Wildco consists of a box-like device with two clam shell jaws containing a chamber volume of 3540 cm^3 (volume of sample). Secured samples were washed through a screened tub, transferred to 500ml polyethelene bottles and preserved in a 10% formaldehyde solution.

Preserved samples from stream and lake study sites were sorted in the laboratory with the aid of a Wild M3 dissecting microscope. In this procedure, benthic macro-invertebrates were removed from detritus and organic material in the sample and preserved in labelled glass vials with a 10% formaldehyde solution.

Preserved invertebrate specimens were then transferred to the Atlantic Reference Centre of the Huntsman Marine Laboratory in St. Andrews, N.B. and identified to species, where possible, using criteria descibed by Bednarik and McCafferty, (1979), Pennak (1953), Merrit and Cummins (1984), Simpson and Bode (1980), Ward and Whipple (1959), and Wiggins (1977).

RESULTS

Relative abundance of each species was compiled and tabulated for each sample from all represented sites and presented in this report.

Insects, which comprised the majority of invertebrates sampled, are listed at the beginning of each table and followed by taxa of the remaining organisms which include amphipods, annelids, molluscs and turbellarians.

ACKNOWLEDGEMENTS

The author is much indebted to W. E. Hogans of the Huntsman Marine Laboratory's Atlantic Reference Centre, who identified invertebrate specimens. Appreciation is also extended to L. Haight who provided the site drawings and to D.R. Alexander and L. Anthony who critically reviewed the manuscript.

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FIG. 4.1 LOCATION OF SAMPLING SITES, JACQUET RIVER WATERSHED, AUGUST 1984

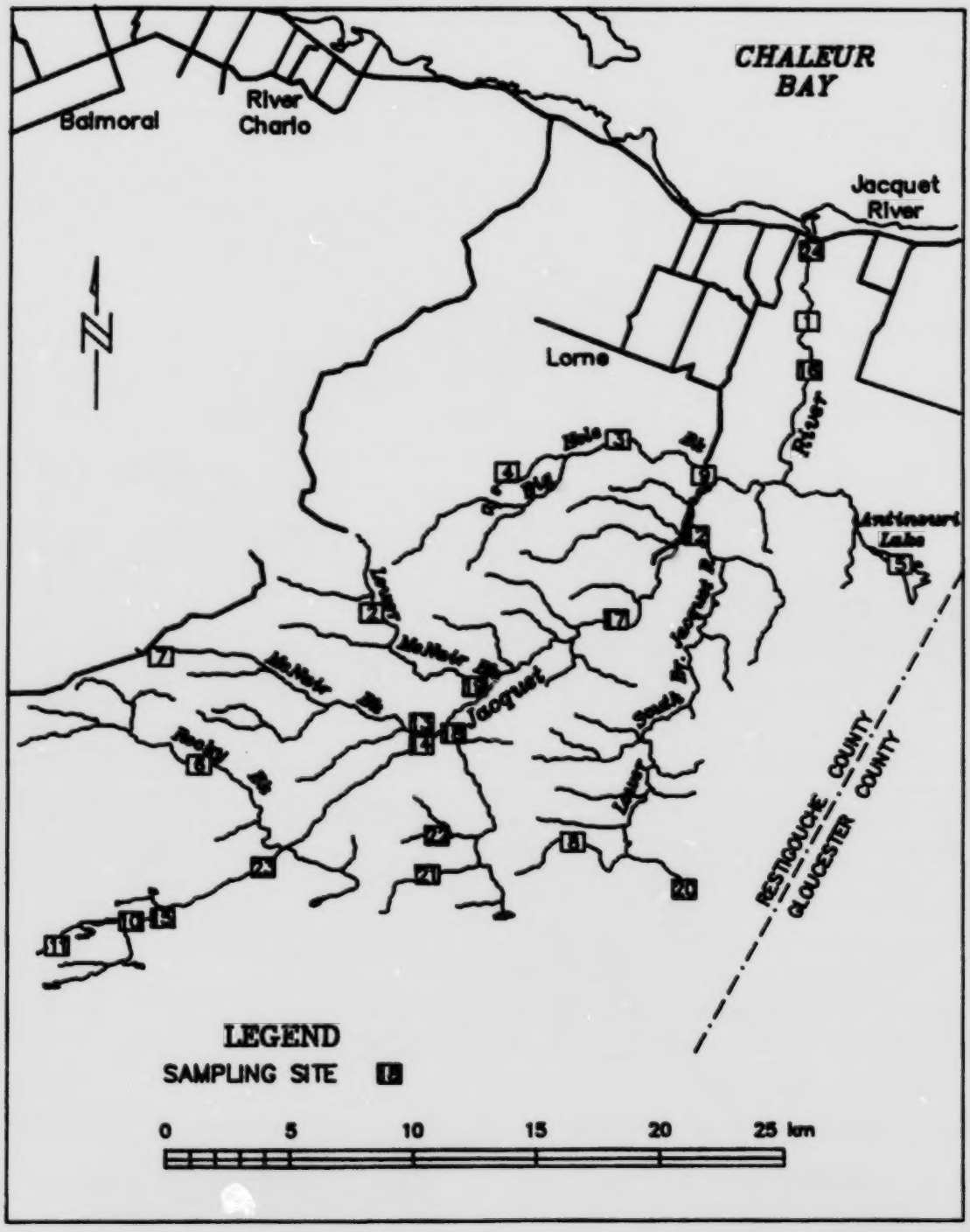


FIG. 4.2 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 1, JACQUET RIVER, AUGUST 9,1984

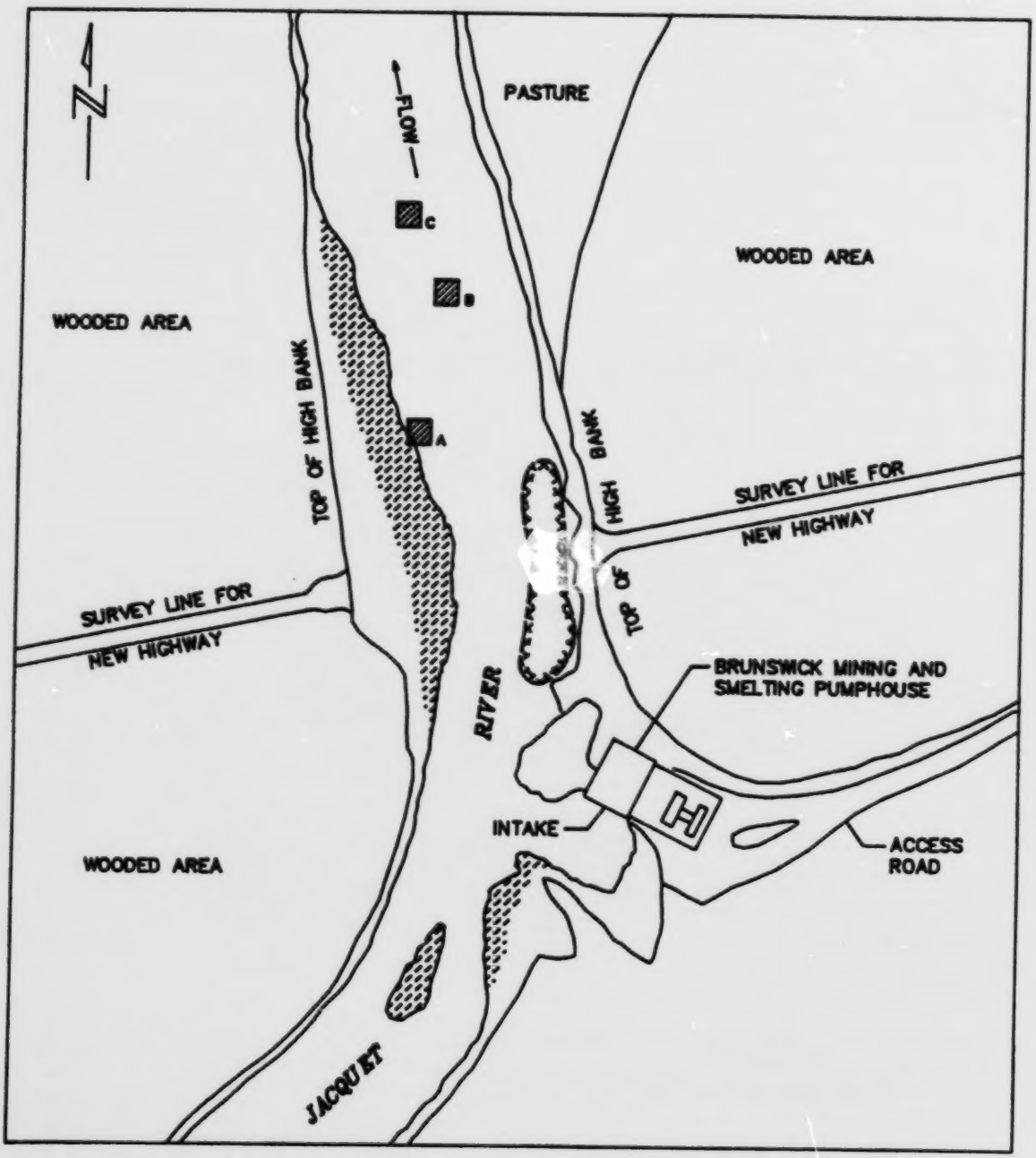


TABLE 4.1

Species Composition and Relative Abundance of Benthic Macro-Invertebrates

SITE 1, JACQUET RIVER, August 9, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
*Heterelmis sp.**		6	1	7	2.3
DIPTERA sp.	1			1	0.3
Chironomidae					
Chironominae					
Tanytarsus sp.	1			1	0.3
Orthocladiinae					
Cardiocladius Albiplumus	3			3	1.0
Cricotopus sp.	3			3	1.0
Heleidae					
Palpomyia sp.		3		3	1.0
Tipulidae					
Tipula sp.			1	1	0.3
Tanyderidae					
Protoplasa fitchii			1	1	0.3
EPHEMEROPTERA sp.		2		2	0.6
Baetidae					
Baetis sp.			1	1	0.3
B. vagans		1		1	0.3
Heptageniidae					
Stenonema femorata	1		1	2	0.6
PLECOPTERA					
Perlidae					
Acroneuria abnormis	1			1	0.3
TRICHOPTERA					
Brachycentridae					
Brachycentrus americanus			1	1	0.3
Hydropsychidae					
Macronema zebratum	1			1	0.3
ODONATA					
Gomphidae					
Gomphus sp.			1	1	0.3
ANNELIDA					
Oligochaeta sp.		10		10	3.3
MOLLUSCA					
Pelecypoda					
Musculium sp.		2		2	0.6
TOTAL	11	24	7	42	14.0

*According to Arnett (1968) the genus *Heterelmis* is more properly named *Stenelmis*

FIG. 4.3 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 2, LOWER MCNAIR BROOK, AUGUST 10,1984

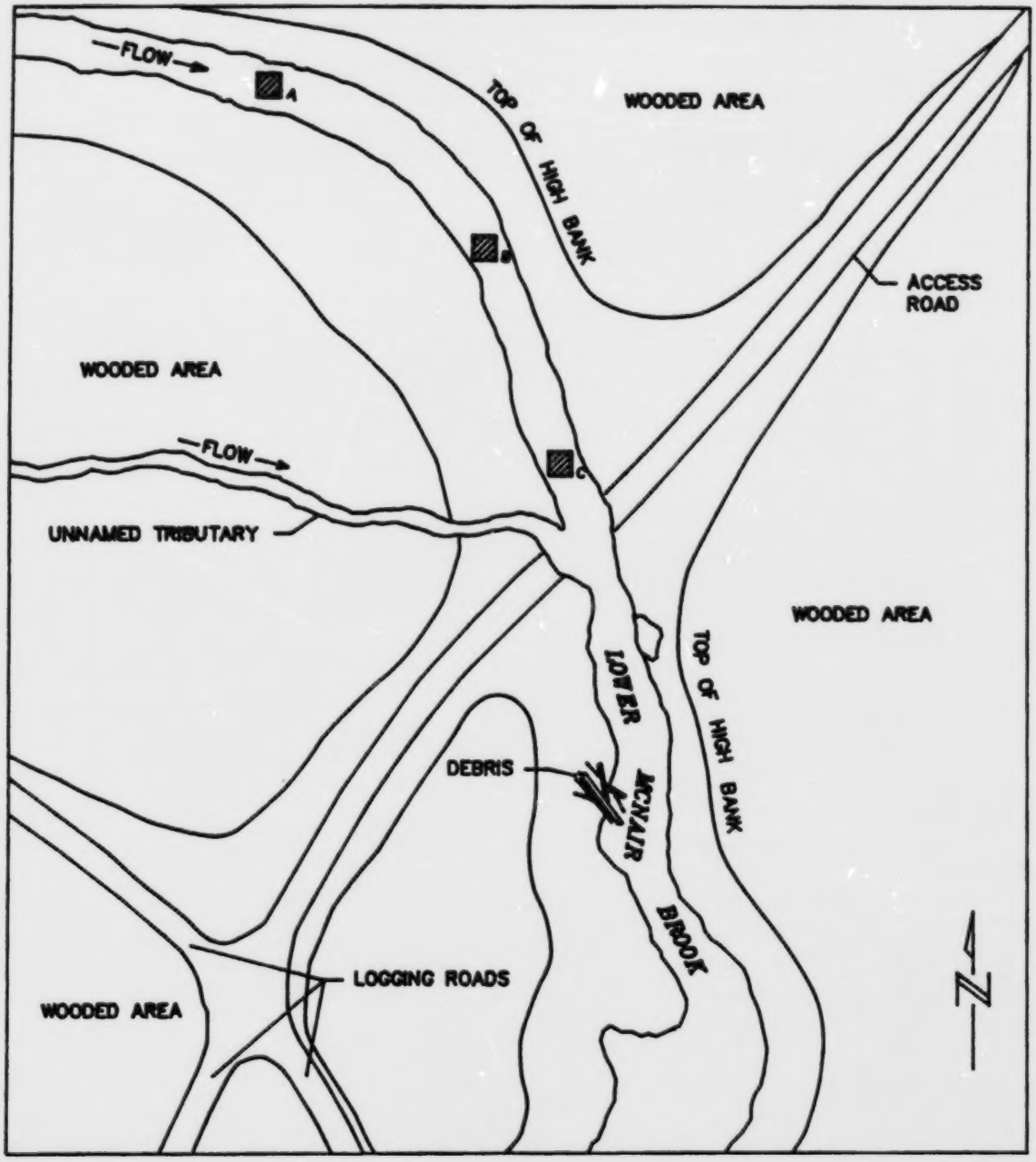


TABLE 4.2
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 2, LOWER MCNAIR BROOK, August 10, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.		59	9	68	22.6
DIPTERA					
Chironomidae					
Chironominae sp.		4		4	1.3
Tendipes tendans	4			4	1.3
Tanytarsus sp.	2			2	0.6
Diamesinae					
Diamesa sp.		7		7	2.3
Orthocladiinae sp.		14	23	37	12.3
Cardiocladius albiplumus	2	1		3	1.0
Eukiefferiella claripennis		2	11	13	4.3
Tanypodinae					
Procladius sp.	1	3		4	1.3
Heleidae					
Palpomyia sp.		2		2	0.6
Rhagionidae					
Atheryx variegata		17	7	24	8.0
Stratomyidae					
Odontomyia sp.		4		4	1.3
Tipulidae					
Hexatoma sp.			2	2	0.6
EPHEMEROPTERA					
Baetidae					
Baetis intermedius		17		17	5.6
B. vagans			2	2	0.6
Ephemerellidae					
Ephemerella attenuata	1	7	6	14	4.6
E. lata			2	2	0.6
E. varga		12		12	4.0
Heptageniidae					
Iron humeralis	1	10		11	3.6
Ironodes sp.			1	1	0.3
Stenonema femorata	2	18		20	6.6
Leptophlebiidae					
Paraleptophlebia guttata	3	9		12	4.0
Tricorythidae					
Tricorythodes sp.		1		1	0.3

TABLE 4.2 (continued)
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 2, LOWER MCNAIR BROOK, August 10, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
ODONATA					
Gomphidae					
Gomphus sp.		6		6	2.0
Lanthus vernalis		7	4	11	3.6
PLECOPTERA					
Chloroperlidae					
Chloroperla cydippe			3	3	1.0
Nemouridae					
Leuctra claasseni		3	3	6	2.0
Perlidae					
Acroneuria abnormis		3		3	1.0
Perlodidae					
Isoperla bilineata			1	1	0.3
Pteronarcyidae					
Pteronarcys nobilis		2		2	0.6
TRICHOPTERA					
Glossosomatidae					
Glossosoma lividum		5		5	1.6
Hydropsychidae sp.			1	1	0.3
Arctopsyche ladogensis	1	25	5	31	10.3
Limnephilidae					
Apatania incerta			1	1	0.3
Platycentropus radiatus			1	1	0.3
Polycentropodidae					
Polycentropus sp.			1	1	0.3
Rhyacophilidae					
Rhyacophila fuscula		2	1	3	1.0
MOLLUSCA					
Gastropoda sp.		1		1	0.3
TOTAL	17	241	84	342	114.0

FIG. 4.4 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 3, BIG HOLE BROOK, AUGUST 11,1984

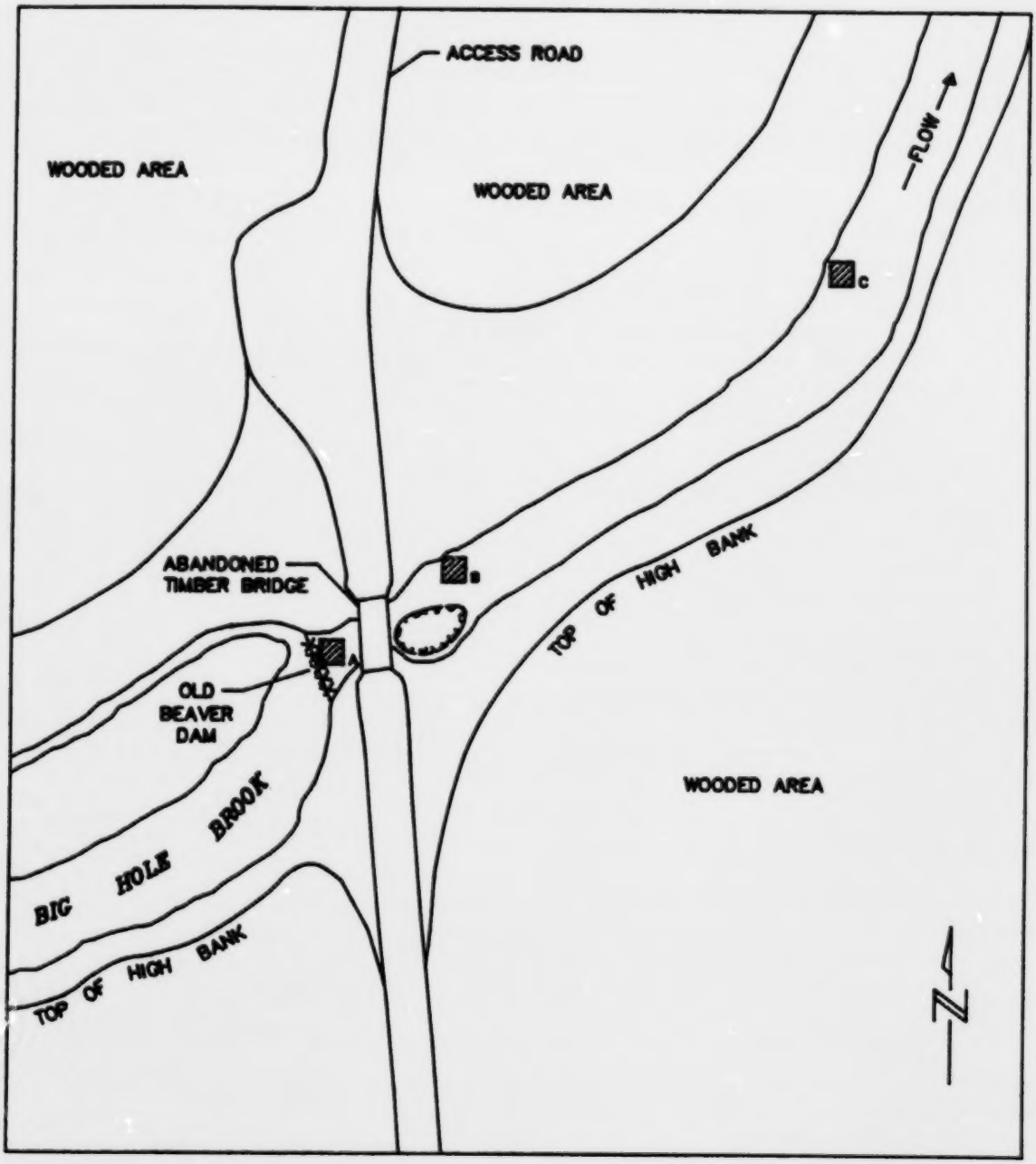


TABLE 4.3
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 3. BIG HOLE BROOK, August 11, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.	6	15	12	33	11.0
DIPTERA					
Chironomidae					
Chironominae					
Dictrotendipes sp.		1		1	0.3
Phaenospectra sp.			4	4	1.3
Diamesinae					
Diamesa spinacies		3	1	4	1.3
Orthocladiinae sp.			2	2	0.6
Gymnometriocnemus brumali		1		1	0.3
Heleidae					
Palpomyia sp.	3	2	2	7	2.3
Rhagionidae					
Atheryx variegata	1	1	1	3	1.0
Tipulidae					
Limnophila sp.		1		1	0.3
Tipula sp.			2	2	0.6
EPHEMEROPTERA					
Baetidae					
Baetis intermedius			11	11	3.6
B. vagans	8	13		21	7.0
Callibaetis americanus	1			1	0.3
Ephemerellidae					
Ephemerella attenuata		1	1	2	0.6
Heptageniidae					
Iron humeralis		4	1	5	1.6
Stenonema femorata	1	4	1	6	2.0
Leptophlebiidae					
Paraleptophlebia guttata		1		1	0.3
HEMIPTERA					
Mesoveliidae					
Mesovelia mulsanti	3			3	1.0
Rhagovelia flavicinta		1		1	0.3
ODONATA					
Gomphidae					
Lanthus vernalis			1	1	0.3

TABLE 4.3(continued)
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 3. BIG HOLE BROOK, August 11, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
PLECOPTERA					
Nemouridae					
Leuctra claasseni		24	4	28	9.3
Perlidae					
Acroneuria abnormis	2	4	3	9	3.0
TRICHOPTERA					
Brachycentridae					
Brachycentrus americanus			4	4	1.3
Hydropsychidae					
Arctopsyche ladogensis			6	6	2.0
Hydropsyche morosa			4	4	1.3
Rhyacophilidae					
Rhyacophila sp.	1	1		2	0.6
AMPHIPODA					
Talitridae					
Hyalella azteca		1		1	0.3
TOTAL	26	78	60	164	54.6

FIG. 4.5 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 5, ANTINOURI LAKE, AUGUST 12,1984

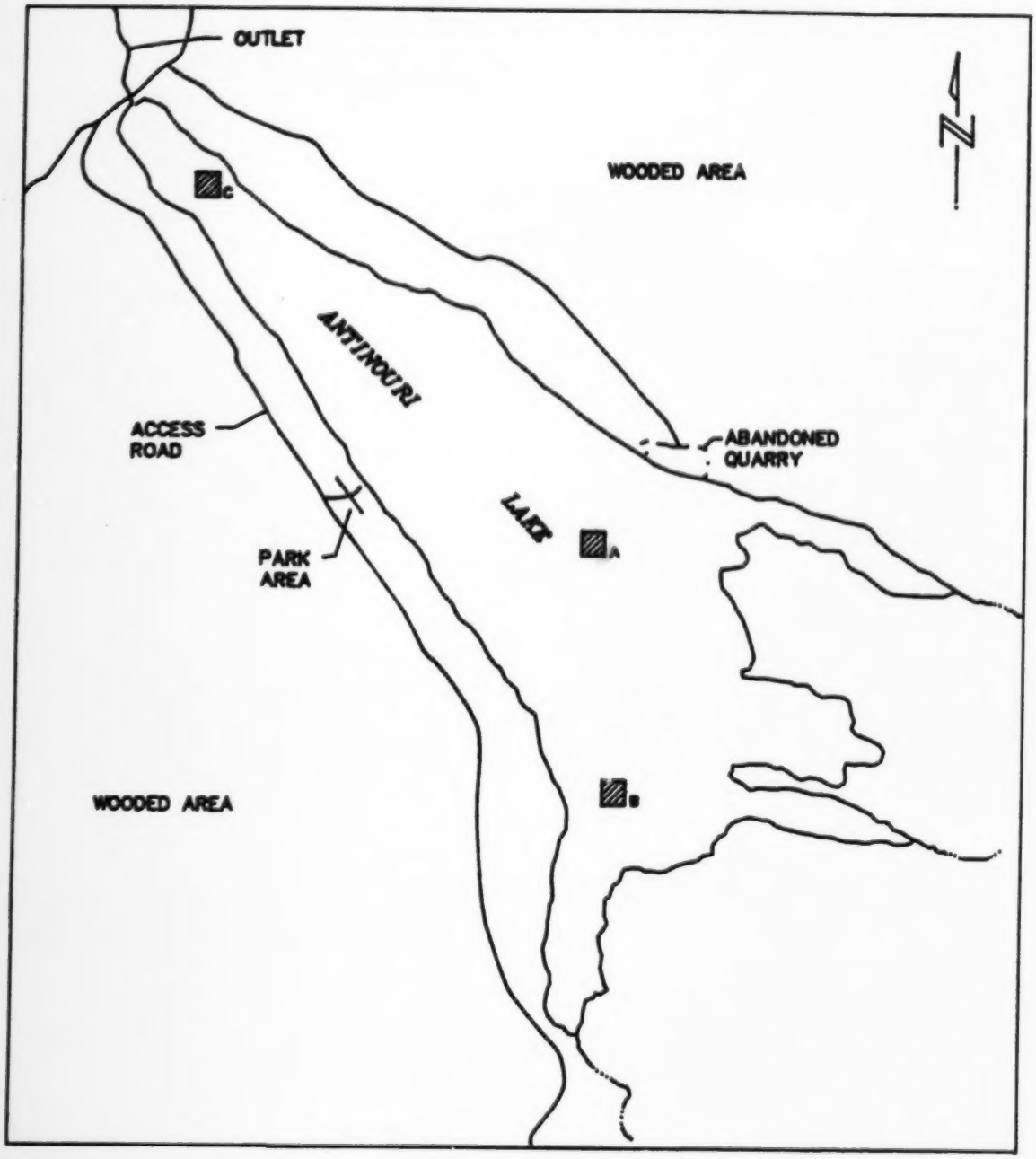


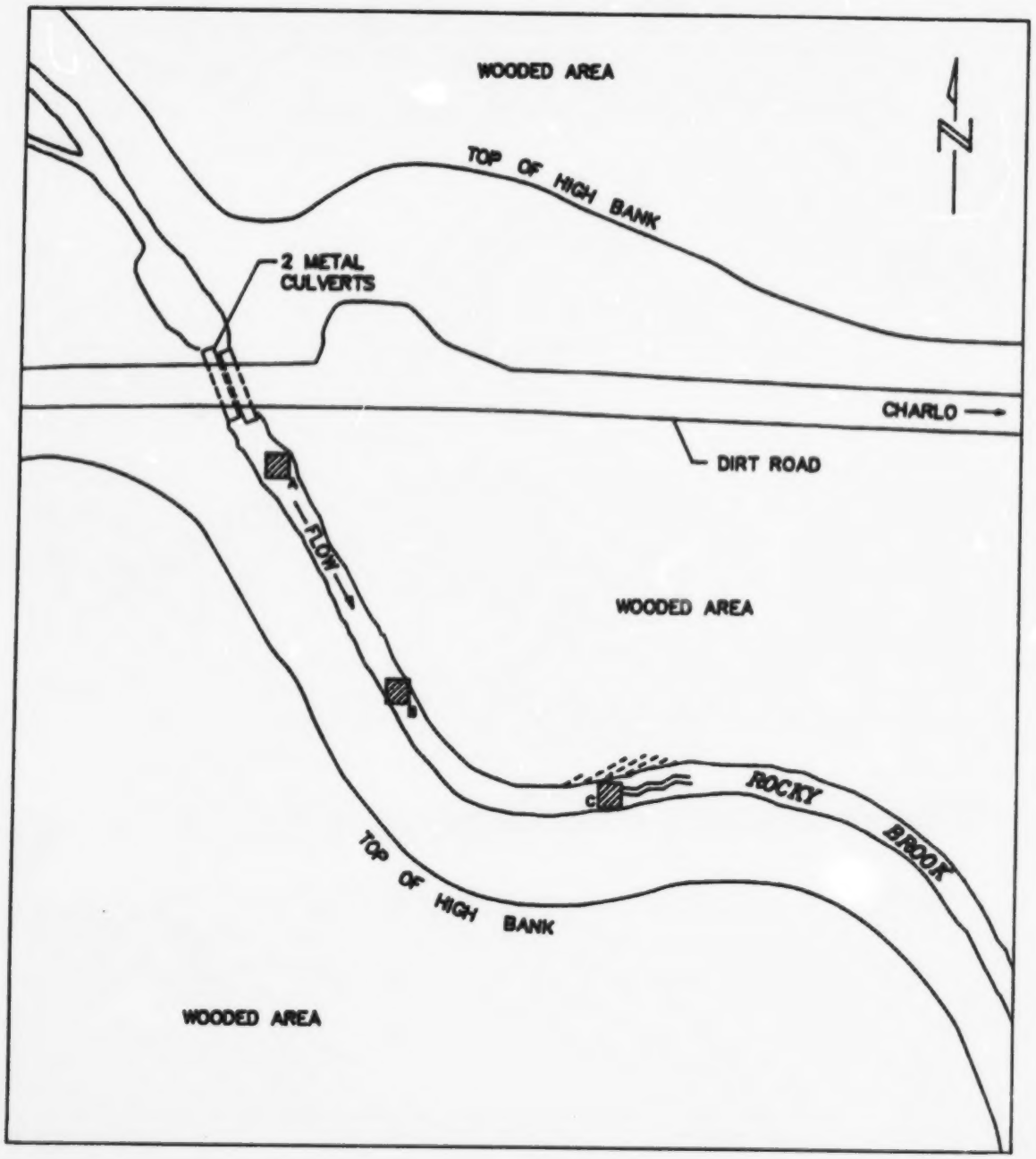
TABLE 4.4

Species Composition and Relative Abundance of Benthic Macro-Invertebrates

SITE 5, ANTINOURI LAKE, August 12, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per 3540 cm^3
COLEOPTERA					
Elmidae					
Heterelmis sp.			11	11	3.6
DIPTERA					
Chironomidae					
Chironominae					
Chironomus sp.		1		1	0.3
Tanypodinae					
Procladius sp.		3		3	1.0
Heleidae					
Palpomyia sp.		1	3	4	1.3
EPHEMEROPTERA					
Tricorythidae					
Tricorythodes sp.	1			1	0.3
ODONATA					
Gomphidae					
Gomphus sp.		2		2	0.6
TRICHOPTERA					
Polycentropodidae					
Polycentropus sp.	1			1	0.3
AMPHIPODA					
Talitridae					
Hyalella azteca	19	16	7	42	14.0
ANNELIDA					
Hirudinea					
Neophalopsis obscurus		1	1	2	0.6
MOLLUSCA					
Pelecypoda					
Musculium sp.		3	19	22	7.3
TOTAL	21	27	41	89	29.6

FIG. 4.6 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 6, ROCKY BROOK, AUGUST 14,1984



LEGEND

- A — BENTHOS SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 10 20 m (APPROX.)

TOPOGRAPHIC MAP 21-O/9

MILITARY GRID 986 885

TABLE 4.5
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 6, ROCKY BROOK, August 14, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.	9	16	30	55	18.3
DIPTERA					
Chironomidae					
Chironominae					
Tanytarsus sp.	1			1	0.3
Orthocladiinae					
Cricotopus sp.			4	4	1.3
Hydrobaenus johannseni			2	2	0.6
Heleidae					
Palpomyia sp.			1	1	0.3
Rhagionidae					
Atheryx variegata	2	7	5	14	4.6
Simuliidae					
Simulium venustrum	6		1	7	2.3
Tipulidae					
Hexatoma sp.			4	4	1.3
EPHEMEROPTERA					
Baetidae					
Baetis intermedius	3			3	1.0
B. vagans			4	4	1.3
Ephemerellidae					
Ephemerella attenuata		3	1	4	1.3
Heptageniidae					
Iron humeralis	9			9	3.0
Stenonema femorata	9	2	4	15	5.0
Leptophlebiidae					
Habrophleboides americana			5	5	1.6
DONATA					
Gomphidae					
Hagenius brevistylus		3	3	6	2.0
Lanthus vernalis			1	1	0.3
PLECOPTERA					
Perlidae					
Neophasganophora capitata	1	6	2	9	3.0
Pteronarcyidae					
Pteronarcys nobilis		1	2	3	1.0

TABLE 4.5(continued)
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 6, ROCKY BROOK, August 14, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
TRICHOPTERA					
Brachycentridae					
Brachycentrus americanus		2		2	0.6
Glossosomatidae					
Glossosoma lividum	1		2	3	1.0
Hydropsychidae					
Arctopsyche ladogensis		8	1	9	3.0
Hydropsyche morosa	3	1	9	13	4.3
Philopotamidae					
Chimarra atterima			4	4	1.3
Rhyacophilidae					
Rhyacophila fuscula	3			3	1.0
ANNELIDA					
Oligochaeta sp.		6	10	16	5.3
MOLLUSCA					
Pelecypoda					
Musculium sp.		6		6	2.0
TOTAL	47	61	95	203	67.6

FIG. 4.7 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 8, LOWER SOUTH BRANCH JACQUET RIVER, AUGUST 18,1984

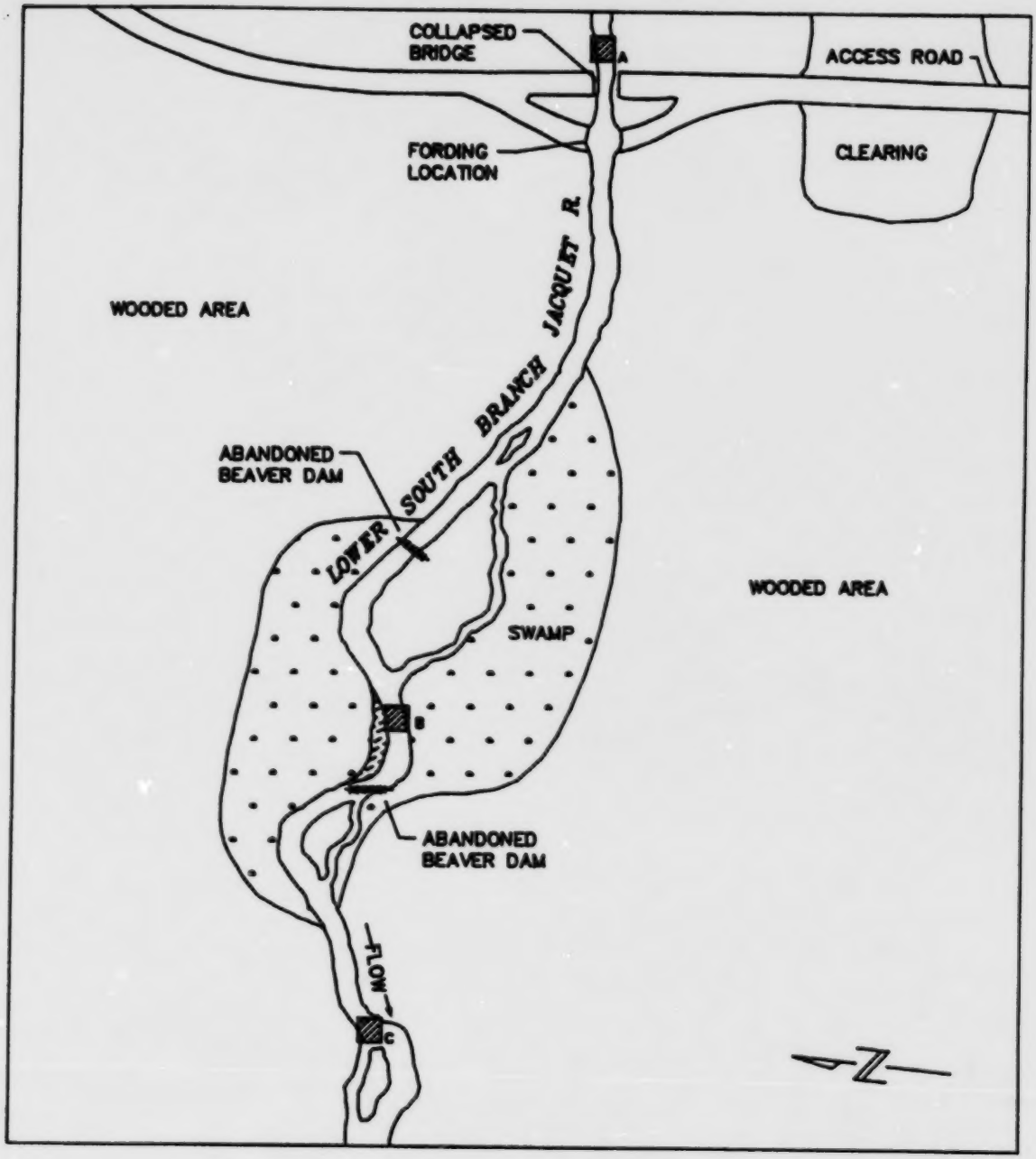


TABLE 4.6

Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 8, LOWER SOUTH BRANCH JACQUET RIVER
August 18, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.	2	4	1	7	2.3
DIPTERA					
Chironomidae					
Diamesinae					
Diamesa spinacies	7			7	2.3
Orthocladiinae sp.		1		1	0.3
Cricotopus sp.		2		2	0.6
Gymnometriocnemus brumalis	1			1	0.3
Padonominae					
Parochlus kiefferi	2			2	0.6
Heleidae					
Palpomyia sp.		3	1	4	1.3
Tipulidae					
Hexatoma sp.			1	1	0.3
Tipula sp.	1			1	0.3
EPHEMEROPTERA sp.		1		1	0.3
Baetidae					
Baetis sp.	1			1	0.3
B. vagans		2		2	0.6
Ephemerellidae					
Ephemerella attenuata		1		1	0.3
Ephemeridae					
Hexagenia bilineata		3	9	12	4.0
Heptageniidae					
Stenonema femorata		2	1	3	1.0
Tricorythidae					
Tricorythodes sp.	1			1	0.3
HEMIPTERA sp.			6	6	2.0
TRICHOPTERA					
Glossosomatidae					
Glossosoma lividum		4		4	1.3
Limnephilidae					
Psycoglypha subborealis	4	1		5	1.6
TOTAL	19	24	19	62	20.6

FIG. 4.8 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 9, BIG HOLE BROOK, AUGUST 17,1984

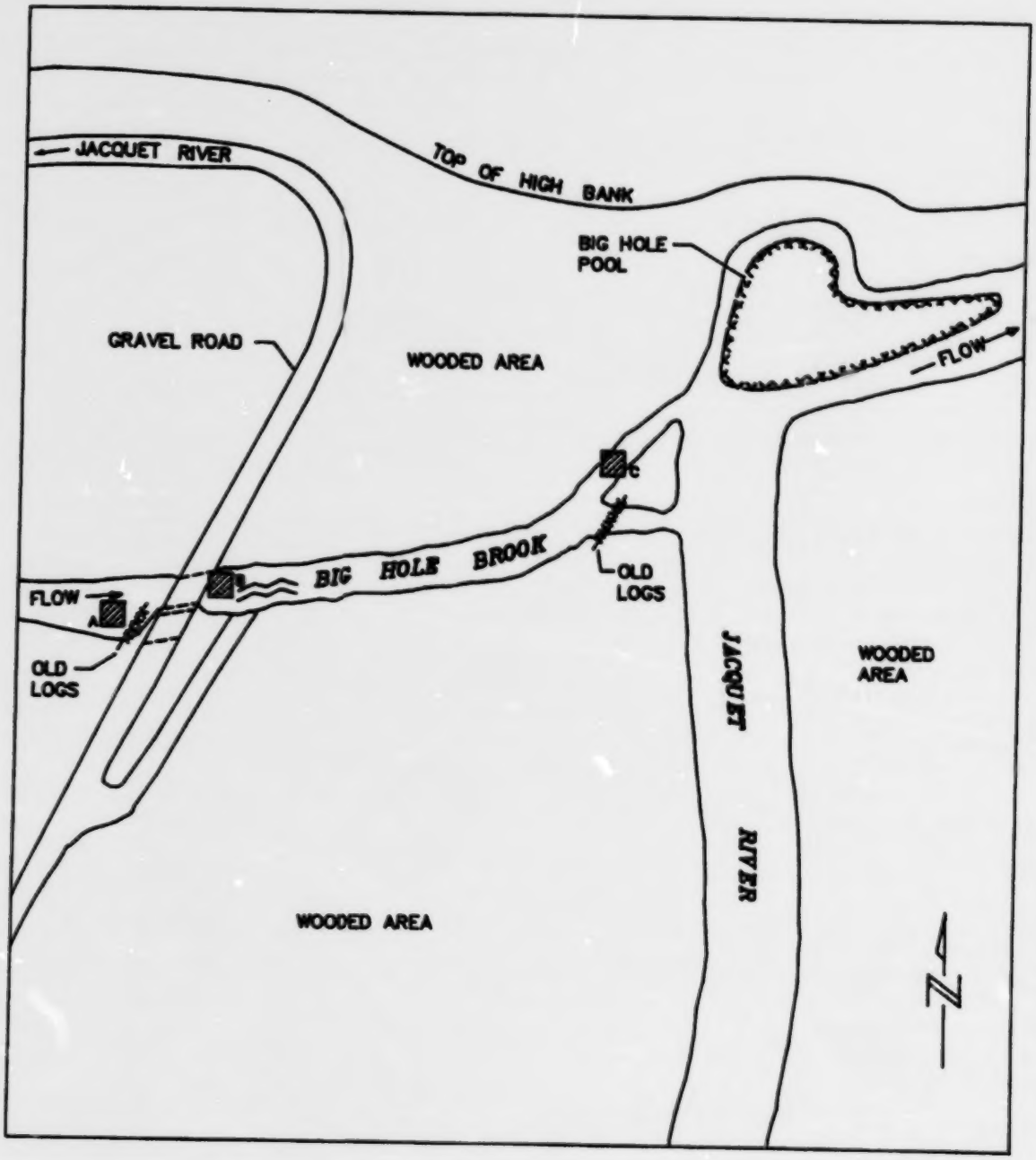


TABLE 4.7
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 9, BIG HOLE BROOK, August 17, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.	10	2	12	24	8.0
DIPTERA					
Chironomidae					
Chironominae					
Tanytarsus sp.	6	1		7	2.3
Orthocladiinae					
Cricotopus sp.			2	2	0.6
Orthocladius sp.		6		6	2.0
Parakieferiella cornata	2			2	0.6
Tanypodinae					
Ablabesmyia sp.			1	1	0.3
Procladius sp.			2	2	0.6
Heleidae					
Palpomyia sp.			1	1	0.3
Rhagionidae					
Atheryx variegata		2		2	0.6
Tipulidae					
Hexatoma sp.			1	1	0.3
EPHEMEROPTERA					
Baetidae					
Baetis sp.	4			4	1.3
Centroptilum album		1	10	11	3.6
Ephemerellidae					
Ephemerella attenuata	6			6	2.0
Heptageniidae					
Stenonema femorata		2	7	9	3.0
Leptophlebiidae					
Habrophlebia vibrans	3			3	1.0
Paraleptophlebia guttata			1	1	0.3
Tricorythidae					
Tricorythodes allectus	2			2	0.6
ODONATA					
Gomphidae					
Hagenius brevistylus	1			1	0.3

TABLE 4.7(continued)
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 9, BIG HOLE BROOK, August 17, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
PLECOPTERA					
Nemouridae					
Leuctra claasseni	4	2	31	37	12.3
Perlidae					
Neophasganophora capitata		2	5	7	2.3
TRICHOPTERA					
Limnephilidae					
Psycoglypha subborealis			1	1	0.3
TOTAL	38	18	74	130	43.3

FIG. 4.9 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 10, TONGUE LAKE BROOK, AUGUST 19,1984

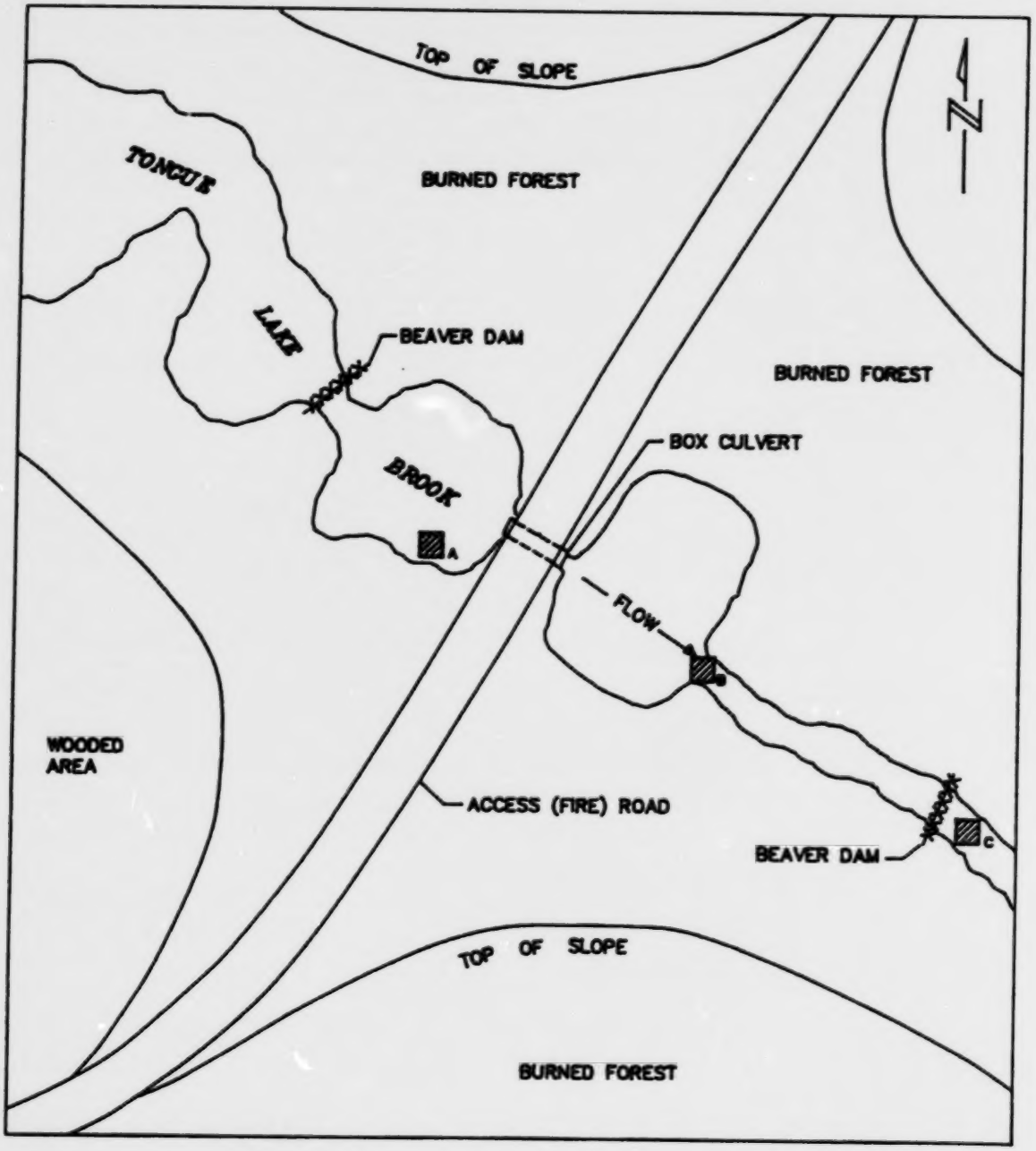


TABLE 4.8

Species Composition and Relative Abundance of Benthic Macro-Invertebrates

SITE 10, TONGUE LAKE BROOK, August 19, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Dysticidae					
Ilybius sp.			2	2	0.6
Elmidae					
Heterelmis sp.	2		3	5	1.6
DIPTERA					
Simuliidae					
Simulium venustrum	4			4	1.3
Stratomyidae					
Odontomyia sp.		1		1	0.3
Tabanidae sp.			1	1	0.3
Tipulidae					
Tipula sp.			3	3	1.0
EPHEMEROPTERA					
Baetidae					
Baetis intermedius			4	4	1.3
B. vagans	2			2	0.6
Pseudocleon sp.		2		2	0.6
Caenidae					
Caenis sp.			2	2	0.6
Ephemerellidae					
Ephemerella attenuata			7	7	2.3
Ephemeridae					
Hexagenia bilineata			2	2	0.6
Heptageniidae					
Stenonema femorata	1			1	0.3
Leptophlebiidae					
Paraleptophlebia guttata			3	3	1.0
ODONATA					
Cordulegastridae					
Cordulegaster sp.		4		4	1.3
TRICHOPTERA					
Hydropsychidae					
Arctopsyche ladogensis	6			6	2.0
Hydropsyche morosa		1		1	0.3
Macronema zebratum	1			1	0.3
Limnephilidae sp.			1	1	0.3
Philopotamidae					
Chimarra atterima		1		1	0.3
Polycentropodidae					
Polycentropus sp.	1			1	0.3

TABLE 4.8 (continued)
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 10, TONGUE LAKE BROOK, August 19, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
AMPHIPODA					
Talitridae					
Hyalella azteca			64	64	21.3
ANNELIDA					
Hirudinea					
Neophalopsis obscurus			1	1	0.3
TOTAL	17	9	93	119	39.6

FIG. 4.10 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 11, HEAD LAKE, AUGUST 21,1984

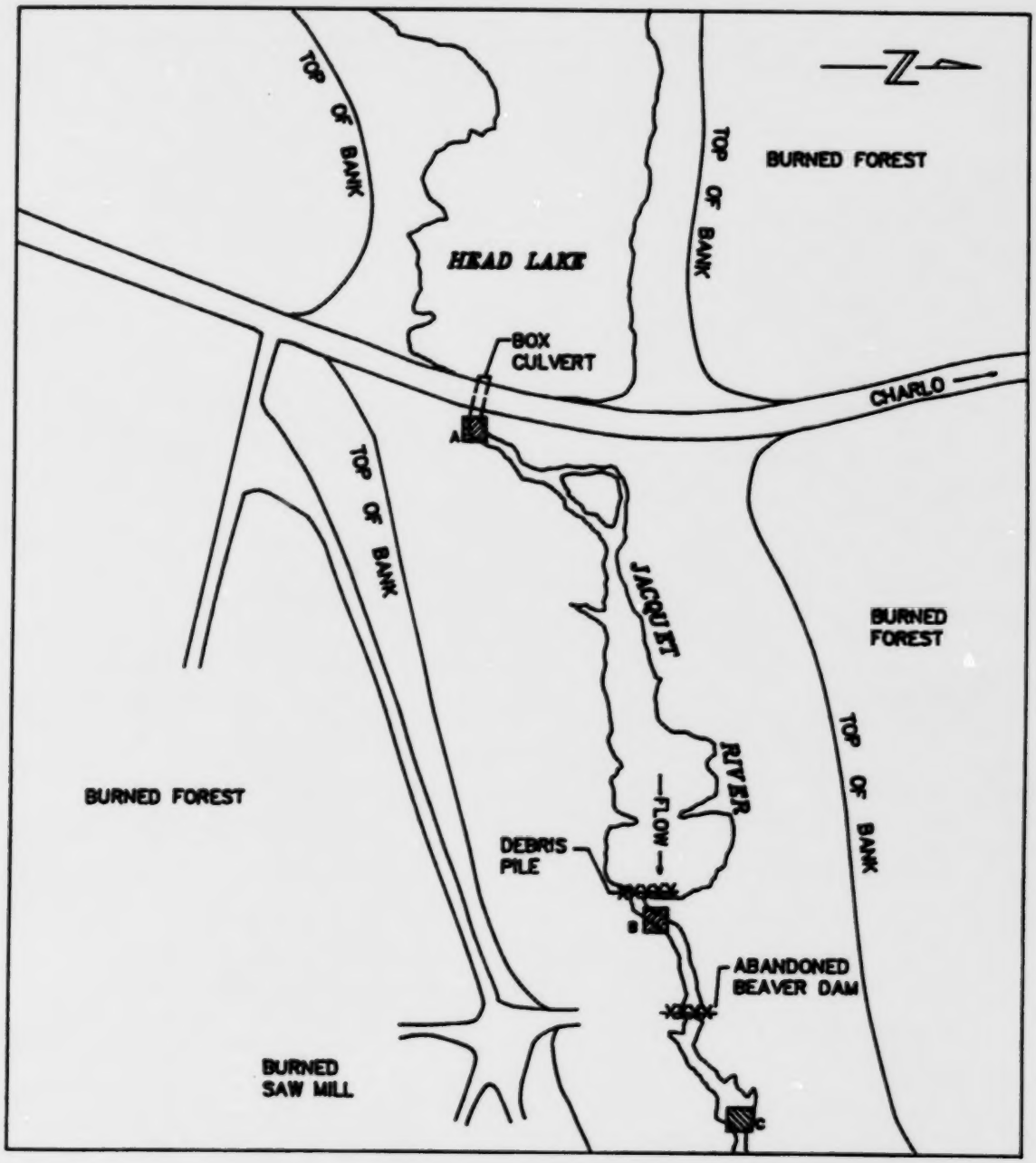
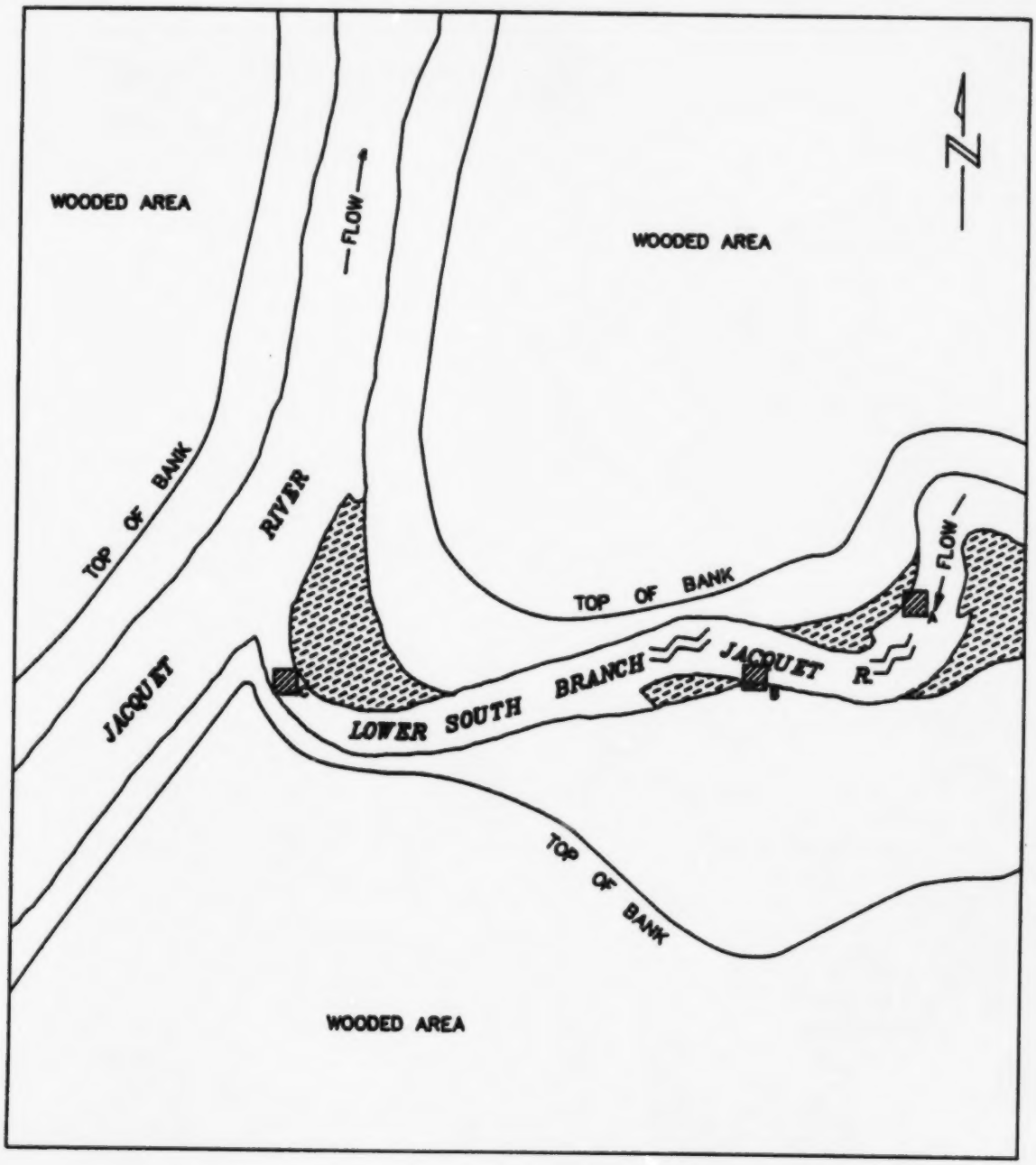


TABLE 4.9
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 11, HEAD LAKE OUTFLOW, August 21, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.		1		1	0.3
DIPTERA					
Chironomidae					
Orthocladiinae					
Eukiefferiella claripennis			2	2	0.6
Tanypodinae					
Procladius sp.			7	7	2.3
Simuliidae					
Simulium venustrum			46	46	15.3
Tipulidae					
Tipula sp.			6	6	2.0
EPHEMEROPTERA					
Baetidae					
Baetis sp.			1	1	0.3
Ephemerellidae					
Ephemerella attenuata			36	36	12.0
Leptophlebiidae					
Paraleptophlebia guttata			1	1	0.3
TRICHOPTERA					
Hydropsychidae					
Hydropsyche morosa			55	55	18.3
Rhyacophilidae					
Rhyacophila sp.	8		22	30	10.0
AMPHIPODA					
Talitridae					
Hyalella azteca		73		73	24.3
ANNELIDA					
Hirudinea					
Neophalopsis obscurus	26	16		42	14.0
PLATYHELMINTHES					
Turbellaria sp.		1	8	9	3.0
MOLLUSCA					
Gastropoda					
Gyraulus circumstriatus		1		1	0.3
Physa sp.		1		1	0.3
Pelecypoda					
Musculium sp.		10		10	3.3
TOTAL	34	103	184	321	107.0

FIG. 4.11 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 12, LOWER SOUTH BRANCH JACQUET RIVER, AUGUST 22,1984



LEGEND

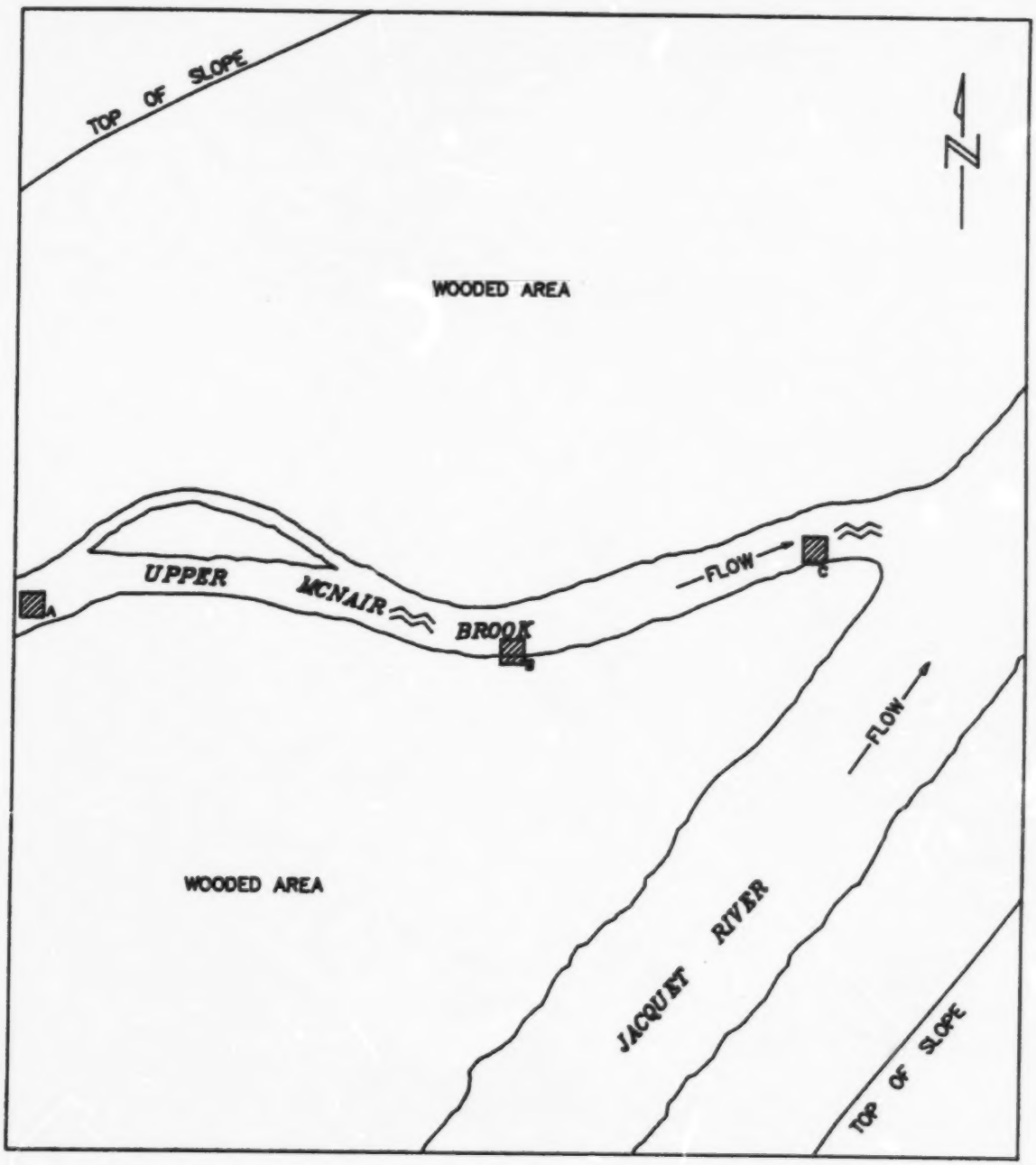
- A — BENTHOS SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 10 20 m (APPROX.)
TOPOGRAPHIC MAP 21-O/16
MILITARY GRID 179 989

TABLE 4.10
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 12, LOWER SOUTH BRANCH JACQUET RIVER
August 22, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
DIPTERA					
Chironomidae					
Orthocladiinae sp.		4		4	1.3
Cricotopus sp.		3		3	1.0
Gymnometriocnemus brumalis			9	9	3.0
Parakieferiella cornata			2	2	0.6
Padonominae					
Parochlus Kiefferi		2		2	0.6
Rhagionidae					
Atheryx variegata	2			2	0.6
Tipulidae					
Limnophila sp.			1	1	0.3
Tipula sp.			2	2	0.6
EPHEMEROPTERA					
Baetidae					
Baetis vagans			4	4	1.3
Ephemerellidae					
Ephemerella attenuata			2	2	0.6
Ephemeridae					
Hexagenia bilineata			3	3	1.0
Heptageniidae					
Stenonema femorata	15		1	16	5.3
Tricorythidae					
Tricorythodes atratus			10	10	3.3
ODONATA					
Gomphidae					
Lanthus vernalis	3			3	1.0
TRICHOPTERA					
Limnephilidae					
Psycoglypha subborealis	9		4	13	4.3
TOTAL	29	9	38	76	25.3

FIG. 4.12 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 13, UPPER MCNAIR BROOK, AUGUST 23,1984



LEGEND

- A — BENTHOS SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 5 10 15 m (APPROX.)
TOPOGRAPHIC MAP 21-O/9
MILITARY GRID 079 901

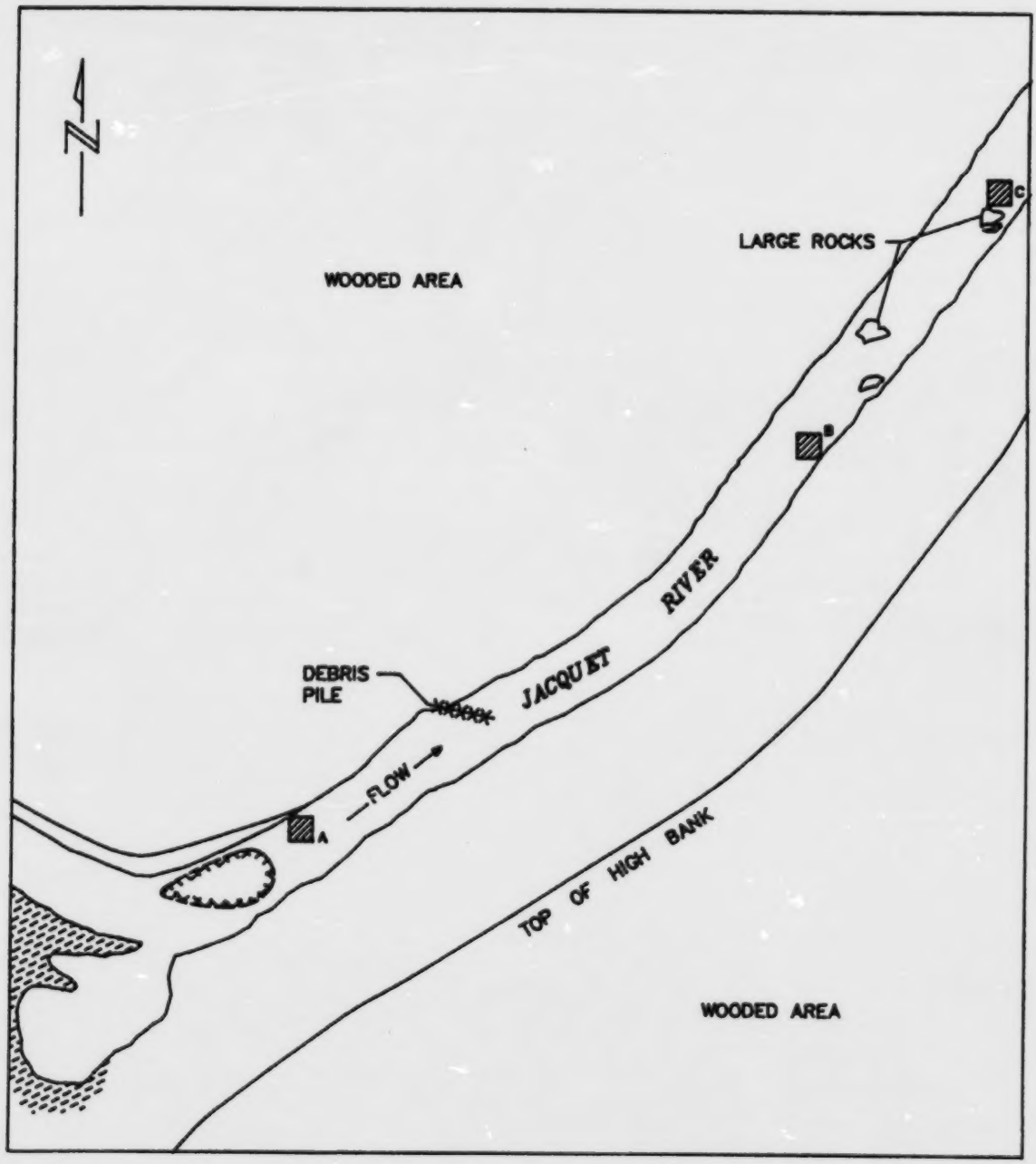
TABLE 4.11

Species Composition and Relative Abundance of Benthic Macro-Invertebrates

SITE 13, UPPER MCNAIR BROOK, August 23, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.	2	1		3	1.0
DIPTERA					
Chironomidae					
Diamesinae					
Diamesa spinacies	2			2	0.6
Orthocladiinae sp.	1	1		2	0.6
Gymnometriocnemus brumalis	2	2		4	1.3
Heleidae					
Palpomyia sp.	2	1		3	1.0
Rhagionidae					
Atheryx variegata			1	1	0.3
Simuliidae					
Simulium sp.		1		1	0.3
Tipulidae					
Hexatoma sp.			1	1	0.3
EPHEMEROPTERA					
Baetidae					
Baetis sp.	1			1	0.3
B. Vagans		6	4	10	3.3
Heptageniidae					
Iron humeralis			1	1	0.3
Stenonema femorata	1	3		4	1.3
PLECOPTERA					
Nemouridae					
Leuctra classeni	3	1	1	5	1.6
TRICOPTERA					
Brachycentridae					
Brachycentrus americanus	17	10		27	9.0
Glossosomatidae					
Glossosoma lividum			3	3	1.0
TOTAL	31	26	11	68	22.6

FIG. 4.13 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 14, JACQUET RIVER, AUGUST 23,1984



LEGEND

- A — BENTHOS SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 10 20 m (APPROX.)

TOPOGRAPHIC MAP 21-O/9

MILITARY GRID 079 900

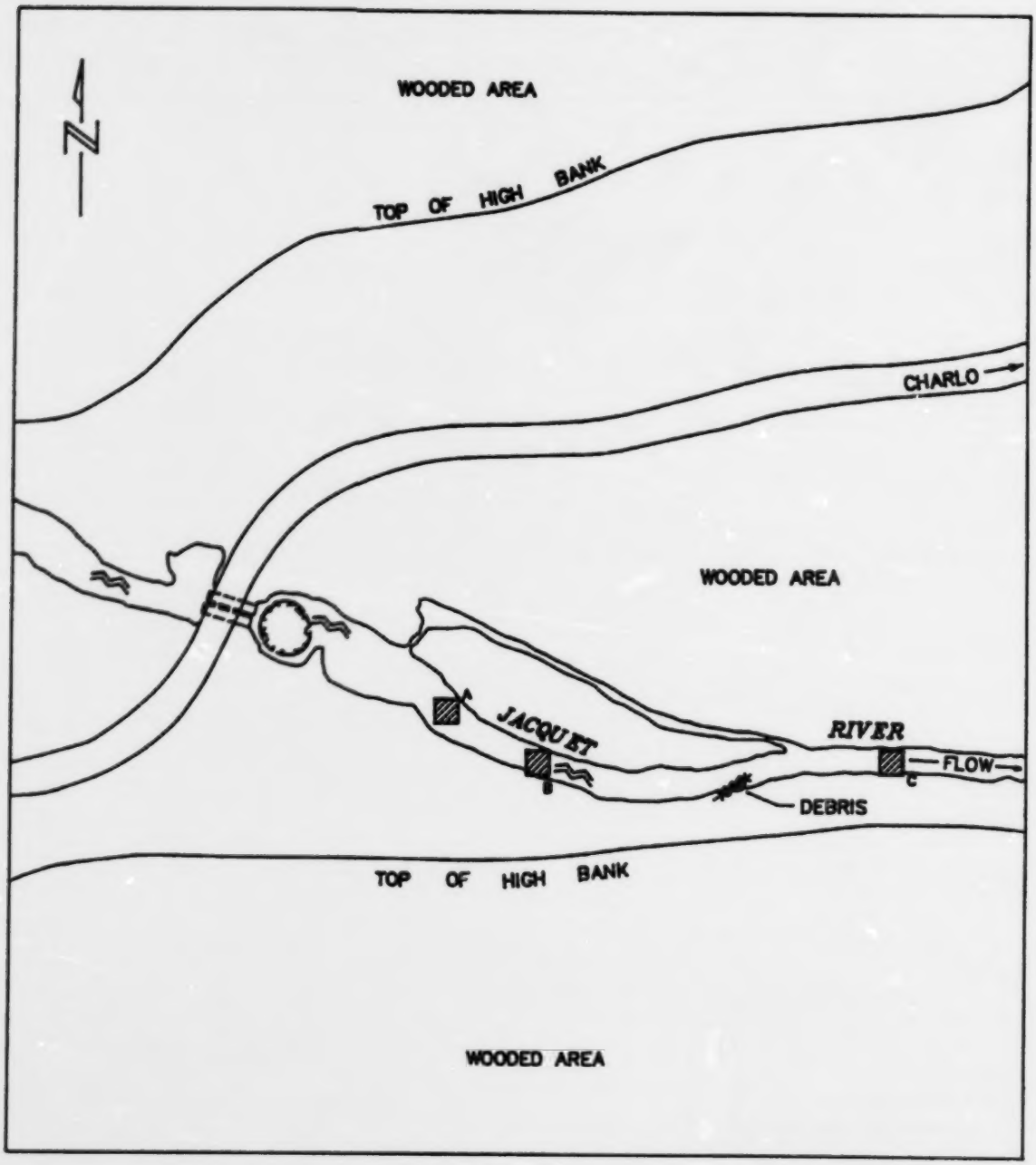
TABLE 4.12

Species Composition and Relative Abundance of Benthic Macro-Invertebrates

SITE 14, JACQUET RIVER, August 23, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.	9	11		20	6.6
DIPTERA sp.		1		1	0.3
PLECOPTERA					
Nemouridae					
Leuctra claasseni	1	1		2	0.6
TRICHOPTERA					
Brachycentridae					
Brachycentrus americanus	79	26	6	111	37.0
Glossosomatidae					
Glossosoma lividum		1		1	0.3
MOLLUSCA sp.	1			1	0.3
TOTAL	90	40	6	136	45.3

FIG. 4.14 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 15, JACQUET RIVER, AUGUST 25,1984



LEGEND

- A — BENTHOS SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 10 20 m (APPROX.)

TOPOGRAPHIC MAP 21-O/9

MILITARY GRID 976 827

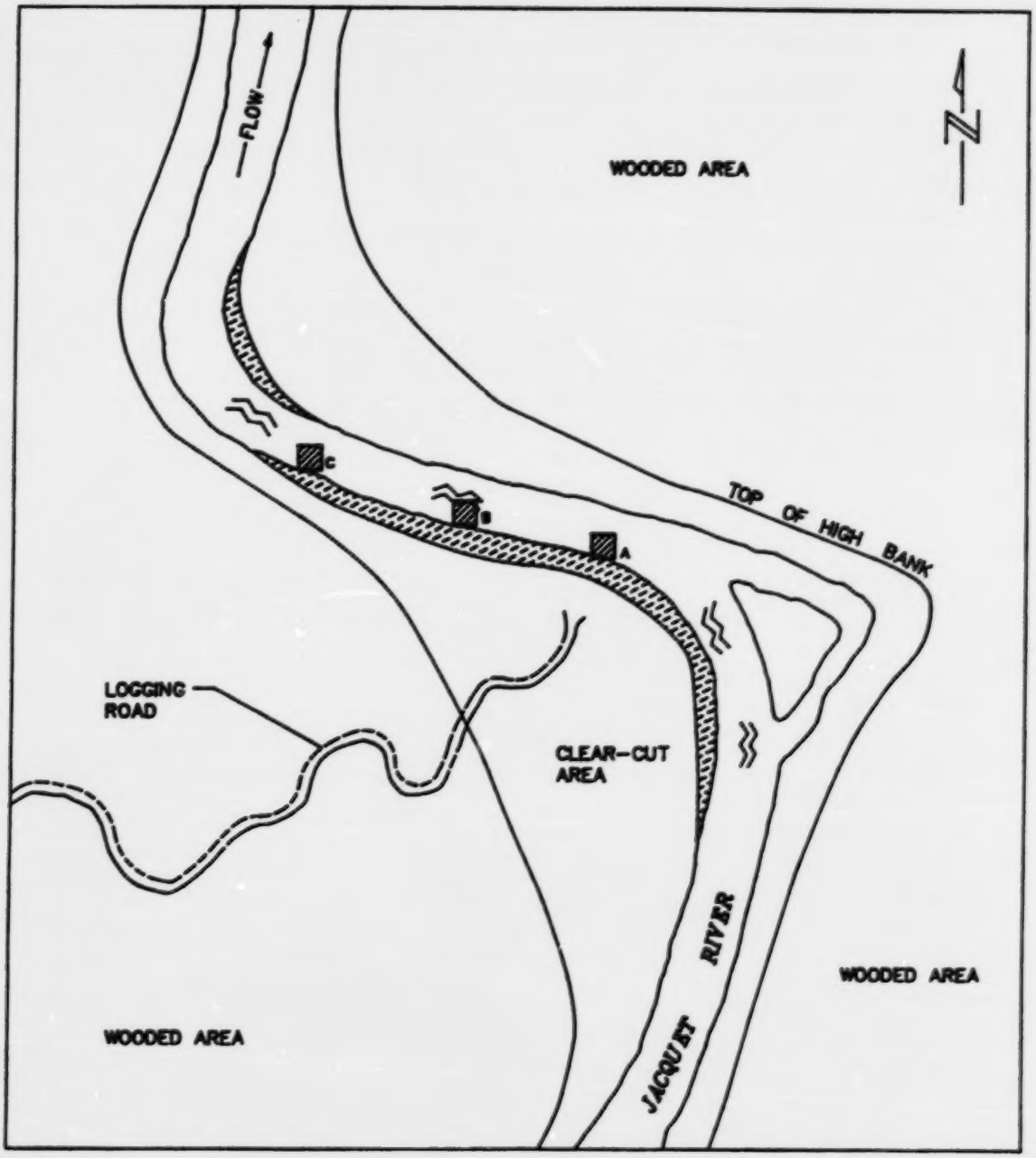
TABLE 4.13
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 15, JACQUET RIVER, August 25, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.	81	55	33	169	56.3
DIPTERA					
Chironomidae					
Diamesinae					
Diamesa spinacies	11			11	3.6
Protanypus sp.	1			1	0.3
Orthocladiinae					
Bryophaenocladius sp.	1			1	0.3
Cardiocladius albiplumus	2			2	0.6
Cricotopus sp.	17			17	5.6
Gymnometriocnemus sp.	3			3	1.0
Padonominae					
Parochlus kiefferi			1	1	0.3
Heleidae					
Palpomyia sp.	1			1	0.3
Rhagionidae					
Atheryx variegata	1		5	6	2.0
Simuliidae					
Simulium venustrum	18	8		26	8.6
EPHEMEROPTERA					
Baetidae					
Baetis sp.			2	2	0.6
B. vagans	4	5		9	3.0
Ephemerellidae					
Ephemerella attenuata	1			1	0.3
Heptageniidae					
Stenonema femorata	2	6	14	22	7.3
Tricorythidae					
Tricorythodes atratus	17			17	5.6
PLECOPTERA					
Pteronarcyidae					
Pteronarcys nobilis		2	2	4	2.6

TABLE 4.13 (continued)
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 15, JACQUET RIVER, August 25, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
TRICHOPTERA					
Brachycentridae					
Brachycentrus americanus	40			48	16.0
Hydropsychidae					
Arctopsyche ladogensis	3	2	1	6	2.0
Hydropsyche morosa	5	6	1	12	4.0
Polycentropodidae sp.	3			3	1.0
Polycentropus sp.		5		5	1.6
Rhyacophilidae					
Rhyacophila fuscula			1	1	0.3
ANNELIDA					
Hirudinea					
Neophalopsis obscurus	1			1	0.3
Oligochaeta sp.	1			1	0.3
PLATYHELMINTHES					
Turbellaria sp.			4	4	1.3
MOLLUSCA					
Gastropoda					
Physa sp.	1	2		3	1.0
TOTAL	222	91	64	377	125.6

FIG. 4.15 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 16, JACQUET RIVER, AUGUST 26,1984



LEGEND

- A — BENTHOS SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 20 40 m (APPROX.)
TOPOGRAPHIC MAP 21-O/16
MILITARY GRID 226 057

TABLE 4.14
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 16, JACQUET RIVER, August 26, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.		1		1	0.3
DIPTERA					
Chironomidae					
Diamesinae					
Diamesa spinacies		1		1	0.3
Tanypodinae					
Procladius sp.		4		4	1.3
Rhagionidae					
Atheryx variegata	1			1	0.3
Simuliidae					
Simulium venustrum			7	7	2.3
Tipulidae					
Hexatoma sp.		1		1	0.3
EPHEMEROPTERA					
Baetidae					
Baetis intermedius		3		3	1.0
B. vagans	2		5	7	2.3
Caenidae					
Caenis simulans			1	1	0.3
Ephemerellidae					
Ephemerella attenuata			2	2	0.6
Heptageniidae					
Stenonema femorata	1	2	1	4	1.3
ODONATA					
Cordulegastridae					
Cordulegaster sp.			3	3	1.0
PLECOPTERA					
Perlidae					
Acroneuria abnormis	1			1	0.3
Neophasganophora capitata		1		1	0.3

TABLE 4.14(continued)
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 16, JACQUET RIVER, August 26, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
TRICHOPTERA					
Brachycentridae					
Brachycentrus americanus	1			1	0.3
Glossosomatidae					
Glossosoma lividum	2			2	0.6
Hydropsychidae					
Arctopsyche sp.			3	3	1.0
A. ladogensis		1	2	3	1.0
Philopotamidae					
Chimarra atterima		1		1	0.3
Polycentropodidae					
Polycentropus sp.	1	1		2	0.6
Rhyacophilidae					
Rhyacophila sp.			2	2	0.6
AMPHIPODA					
Talitridae					
Hyalella azteca			109	109	36.3
ANNELIDA					
Hirudinea					
Helobdella sp.			11	11	3.6
Neophalopsis obscurus			21	21	7.0
TOTAL	9	16	167	192	64.0

FIG. 4.16 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 17, AUGUST 27,1984

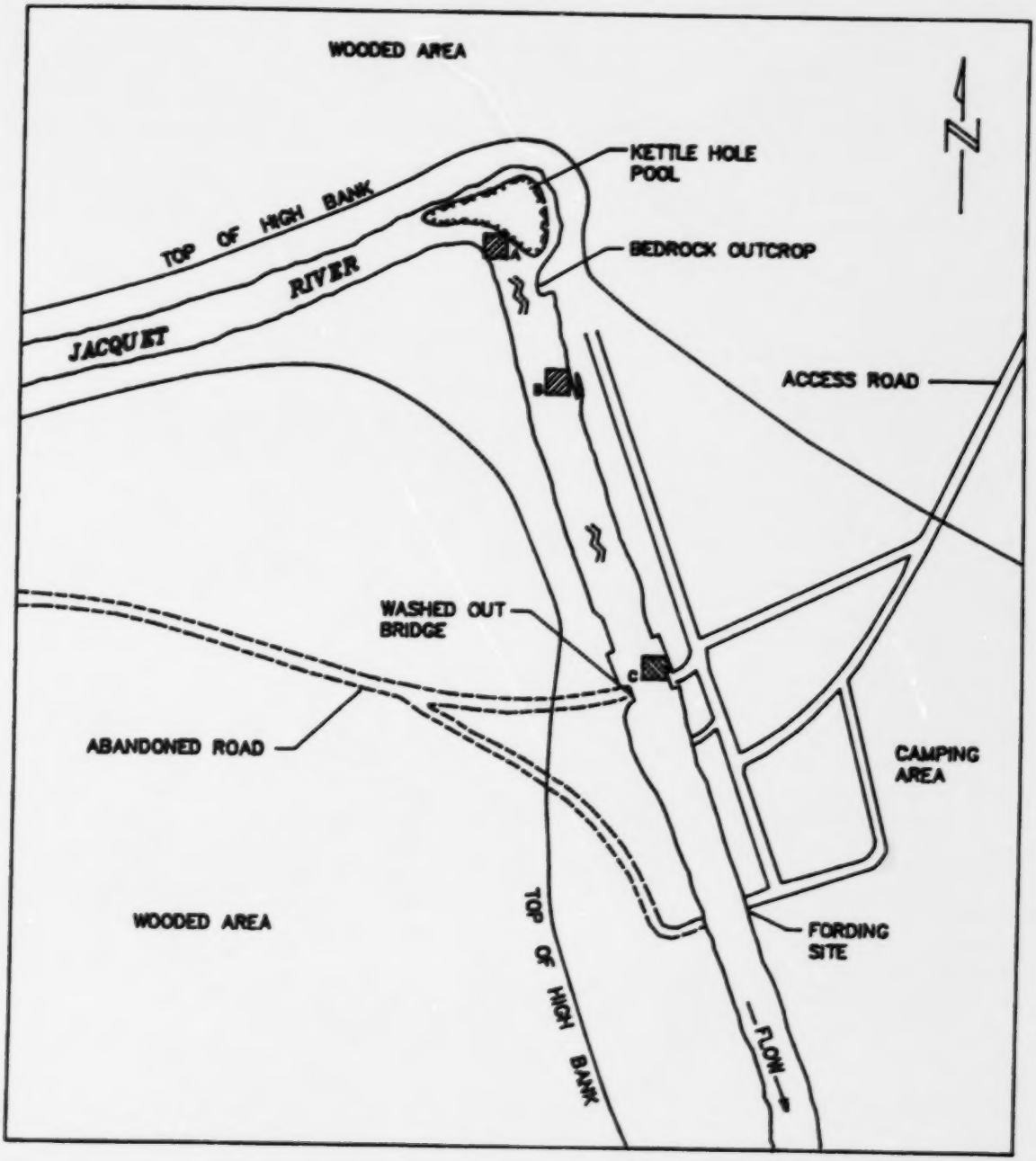
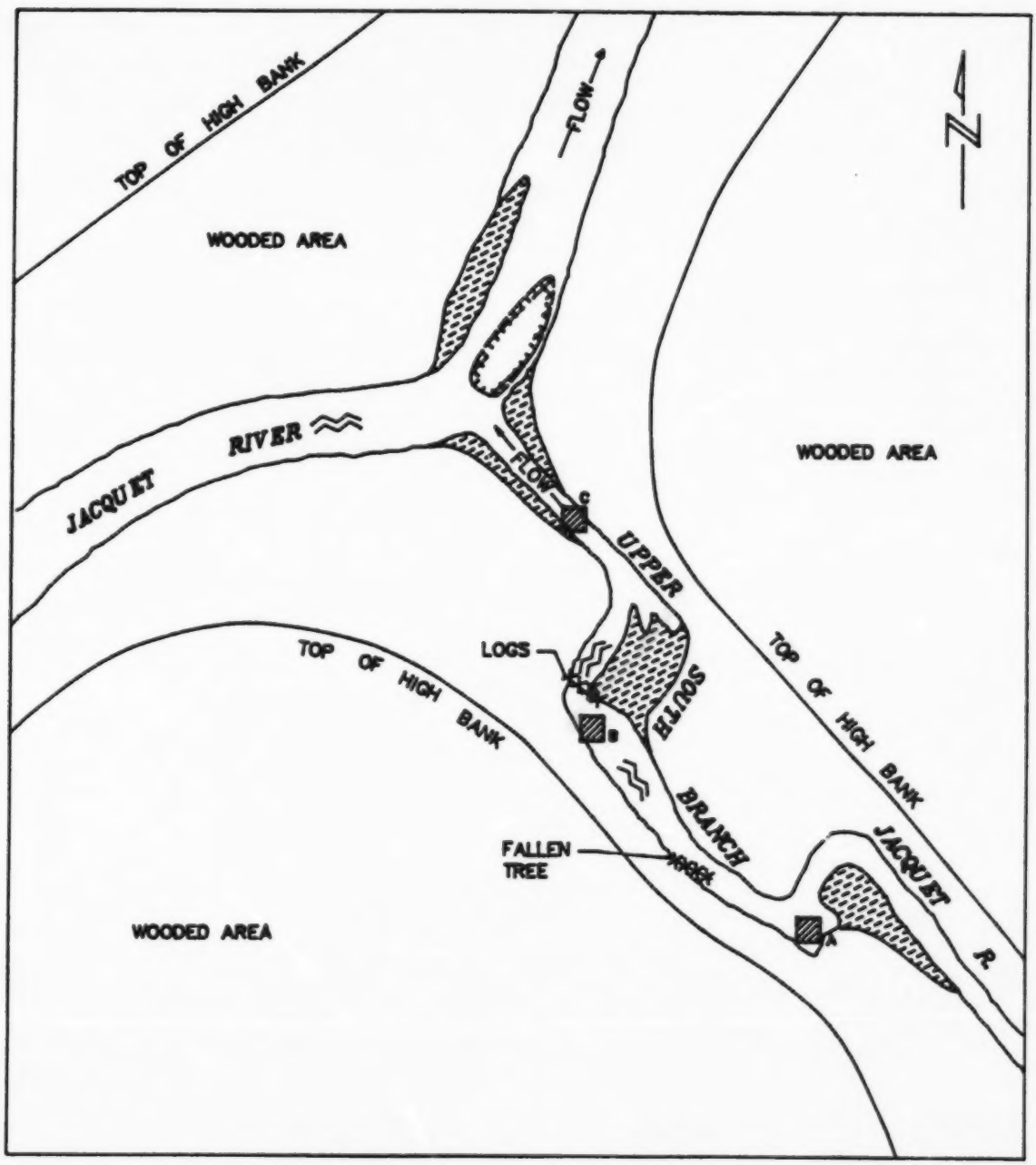


TABLE 4.15
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 17, JACQUET RIVER, August 27, 1984

Species	Relative Abundance Sample A	Relative Abundance Sample C	Total No.	Average No. per .09m²
COLEOPTERA				
Elmidae				
Heterelmis sp.	33		33	16.5
DIPTERA				
Heleidae				
Palpomyia sp.	18		18	9.0
Rhagionidae				
Atheryx variegata	2		2	1.0
Tipulidae				
Hexatoma sp.	1		1	0.5
Limnophila sp.		1	1	0.5
EPHEMEROPTERA				
Baetidae				
Baetis sp.		4	4	2.0
B. intermedius	4		4	2.0
Baetiscidae				
Baetisca obesa	1	1	2	1.0
Ephemerellidae				
Ephemerella attenuata	6	4	10	5.0
Ephemeridae				
Hexagenia bilineata		1	1	0.5
Heptageniidae				
Stenonema femorata	3	12	15	7.5
Leptophlebiidae				
Paraleptophlebia guttata	4	1	5	2.5
Siphlonuridae				
Ameletus sp.		1	1	0.5
HYMENOPTERA				
Ichneumidae sp.	1		1	0.5
TRICHOPTERA				
Brachycentridae				
Brachycentrus americanus	2		2	1.0
ANNELIDA				
Oligochaeta sp.		11	11	5.5
TOTAL	75	36	111	55.5

FIG. 4.17 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 18, UPPER SOUTH BRANCH JACQUET RIVER, AUGUST 28,1984



LEGEND

- A — BENTHOS SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 10 20 m (APPROX.)

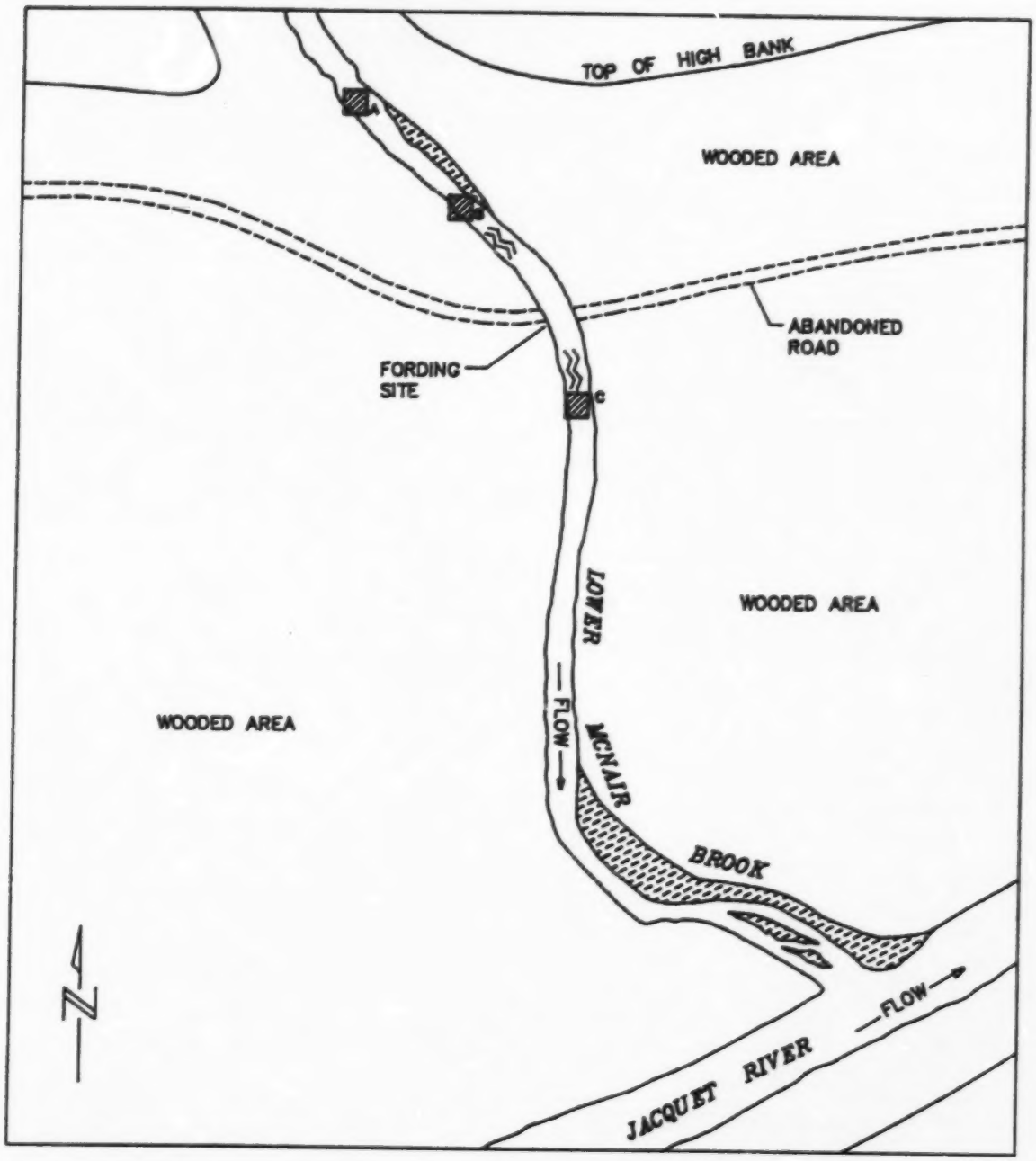
TOPOGRAPHIC MAP 21-O/9

MILITARY GRID 084 903

TABLE 4.16
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 18, UPPER SOUTH BRANCH JACQUET RIVER
August 28, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.	1			1	0.3
DIPTERA					
Rhagionidae					
Atheryx variegata	2	2		4	1.3
Simuliidae					
Simulium venustrum		2		2	0.6
EPHEMEROPTERA					
Baetidae					
Baetis sp.	7		5	12	4.0
Ephemerellidae					
Ephemerella attenuata		3		3	1.0
Heptageniidae					
Iron humeralis	3	1		4	1.3
Stenonema femorata		7	16	23	7.6
Tricorythidae					
Tricorythodes atratus			2	2	0.6
PLECOPTERA					
Perlidae					
Acroneuria abnormis		1		1	0.3
Pteronarcyidae					
Pteronarcys nobilis		1		1	0.3
TRICHOPTERA					
Brachycentridae					
Brachycentrus americanus	64	9	3	76	25.3
Glossosomatidae					
Glossosoma lividum		16	1	17	5.6
Hydropsychidae					
Hydropsyche morosa		3		3	1.0
Philopotamidae					
Chimarra atterima		4		4	1.3
TOTAL	77	49	27	153	51.0

FIG. 4.18 LOCATION OF BENTHOS SAMPLING STATIONS, SITE 19, LOWER MCNAIR BROOK, AUGUST 28,1984



LEGEND

- A — BENTHOS SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 10 20 m (APPROX.)

TOPOGRAPHIC MAP 21-O/9

MILITARY GRID 098 919

TABLE 4.17
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 19, LOWER MCNAIR BROOK, August 28, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
COLEOPTERA					
Elmidae					
Heterelmis sp.			6	6	2.0
DIPTERA					
Chironomidae					
Orthocladiinae					
Abiskomyia sp.	2			2	0.6
Parakieferiella cornata	2			2	0.6
Tanypodinae					
Procladius sp.		5		5	1.6
Heleidae					
Palpomyia sp.	1	1		2	0.6
Rhagionidae					
Atheryx variegata		2	3	5	1.6
Simuliidae					
Simulium sp.		1		1	0.3
S. venustrum	2			2	0.6
Tipulidae					
Limnophila sp.		1		1	0.3
EPHEMEROPTERA					
Baetidae					
Baetis sp.		6	1	7	2.3
B. vagans	18			18	6.0
Ephemerellidae					
Ephemerella doris		3		3	1.0
Heptageniidae					
Stenonema femorata	7			7	2.3
ODONATA					
Cordulegastridae					
Cordulegaster sp.	1			1	0.3
PLECOPTERA					
Nemouridae					
Leuctra claasseni		1		1	0.3
Perlidae					
Acroneuria abnormis	1			1	0.3
Pteronarcyidae					
Pteronarcys nobilis	1	1	3	5	1.6

TABLE 4.17(continued)
Species Composition and Relative Abundance of Benthic Macro-Invertebrates
SITE 19, LOWER MCNAIR BROOK, August 28, 1984

Species	Relative Abundance Sample A	Sample B	Sample C	Total No.	Average No. per .09m²
TRICHOPTERA					
Brachycentridae					
Brachycentrus americanus	39	86	131	256	85.3
Glossosomatidae					
Glossosoma lividum	12	32	79	123	41.0
Hydropsychidae					
Arctopsyche ladogensis	1	1	6	8	2.6
Hydropsyche morosa	1		1	2	0.6
Rhyacophilidae					
Rhyacophila fuscula			2	2	0.6
TOTAL	88	140	232	460	153.3